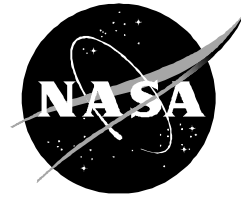


# NASA Facts

National Aeronautics and  
Space Administration

Lyndon B. Johnson Space Center  
Houston, Texas 77058



## International Space Station

August 1998

### Shuttle Mission STS-88: *Launching a New Era in Earth Orbit*

Launch Date/Site: 3:45 a.m. CDT Dec. 3, 1998/Kennedy Space Center - Pad 39B

Orbiter: Endeavour - 13th Flight

Orbit/Inclination: 200 statute miles/51.6 degrees

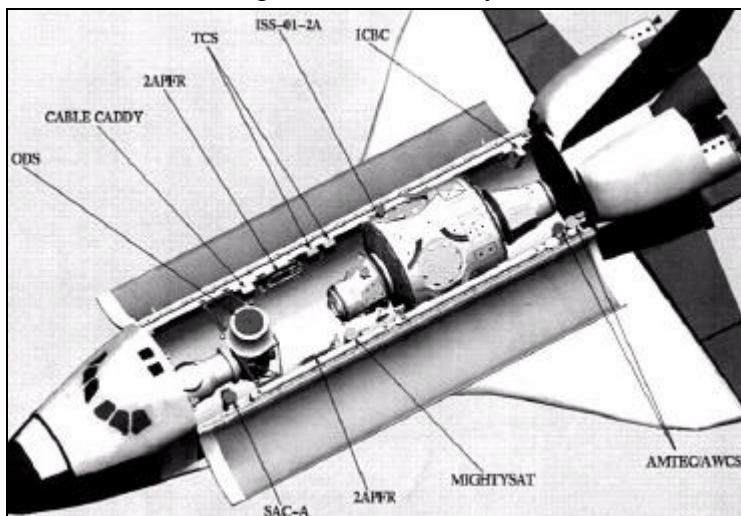
Mission Duration: 11 days

Cargo Bay Payloads: Unity node with two pressurized mating adapters (PMAs)  
(International Space Station Assembly Flight 2A)  
IMAX Cargo Bay Camera (ICBC)  
Mightysat 1 (deployed after ISS activities completed)

Flight Crew: Robert D. Cabana (Col., USMC), Commander  
Frederick Sturckow (Major, USMC), Pilot  
Nancy Currie (Major, USA), Mission Specialist  
Jerry Ross (Col., USAF), Mission Specialist (EV crewmember)  
Jim Newman, Ph.D., Mission Specialist (EV crewmember)  
Sergei Krikalev, Mission Specialist

#### STS-88 Overview

The crew, trainers, mission planners and flight controllers for Space Shuttle mission STS-88 have been training for more than a year at the Johnson Space Center, Houston, to



prepare for the task of starting the largest, international cooperative space venture in history. The Space Shuttle Endeavour is scheduled for a launch in December 1998 to carry the Unity node and two mating adapters into orbit, the first U.S.-built components of the International Space Station. Endeavour's launch will

*STS-88 cargo bay layout: docking system forward, Node 1 aft*

follow the launch of the first element of the station – the Zarya control module – scheduled for Dec. 3, 1998. Zarya will be boosted into orbit by a Russian Proton rocket from the Baikonur Cosmodrome in Kazakhstan. Funded by the U.S. but built by Boeing and the Russian Space Agency, the FGB is a self-supporting, active vehicle that will act like a space tugboat for the early station, providing propulsion and power. After it achieves orbit, it will await the arrival of Endeavour and Unity, the main connecting point for later U.S. station modules and components.

Astronaut Robert D. (Bob) Cabana (Col., USMC) will command STS-88. Joining Cabana on the flight deck of Endeavour will be pilot Frederick "Rick" Sturckow (Major, USMC). Rounding out the crew are Mission Specialists Nancy Currie (Major, USA), Jerry Ross (Col., USAF), Jim Newman, Ph.D., and Sergei Krikalev, a Russian cosmonaut. Ross and Newman also are designated extravehicular activity (EVA) crewmembers and will perform three spacewalks during the mission. STS-88 marks Cabana's fourth flight in space. He served as chief of the Astronaut Office at JSC from 1994 until his selection for the STS-88 crew. Currie and Newman each will be making their third flight into space. Ross will be making his sixth space flight. Sturckow will be making his first space flight. Krikalev has flown in space three times, twice on the Mir space station and once on the Shuttle. Krikalev also is a member of the first crew that will live aboard the new station in mid-1999.

### **Zarya Rendezvous and Capture**

The Shuttle's rendezvous with Zarya actually begins with the precisely timed launch of Endeavour. Periodically during the 48 hours following launch, a series of rendezvous maneuvers will be performed by Cabana and Sturckow to slowly close in on the orbiting Zarya. A day before the final rendezvous with Zarya, Currie will use the Shuttle's robotic arm to lift Unity from its horizontal berth in the aft cargo bay and securely latch it vertically atop the Orbiter Docking System in the forward portion of the bay.

The final approach to the Zarya will be flown manually by Cabana, moving straight up from underneath the module along an imaginary "R-Bar," or radius vector. This approach will be similar to those flown by the Shuttle during dockings with the Russian Mir Space Station. As the Shuttle closes in on Zarya, Currie will maneuver the robotic arm to a position above the cargo bay, in place to latch onto the module. Cabana will complete the rendezvous by placing the edge of Endeavour's payload bay within about 10 feet of Zarya, allowing Currie to capture the module with the arm and dock it on the Node's mating adapter.

Because the view of the Zarya from the crew cabin windows will be blocked by Unity, the final minutes of the rendezvous and capture will be conducted by the crew using only television monitors and the assistance of the Orbiter Space Vision System, an optical alignment aid that has been extensively tested on Shuttle flights leading up to STS-88. The alignment system uses the orbiter's closed circuit television system's view of special markings on the Zarya module to create a precise maneuvering aid for the crew when a direct line of sight is unavailable.

Unity is launched with a conical mating adapter attached to either end. One will serve as a permanent connection between Unity and Zarya while the other will serve as a docking port for future Shuttle missions. Unity will be launched with one stowage rack inside loaded with equipment that will be used by the first station crew when they arrive in early 1999. Unity has room for three more racks to be delivered later in the station's assembly.

### **STS-88 Extravehicular Activity**

Once Zarya and Unity are attached, Ross and Newman will conduct three spacewalks, or EVAs, to connect power and data transmission cables between Unity, the mating adapters and Zarya. One six-hour spacewalk will be carried out every other day, with the first occurring the day after the Zarya rendezvous and docking.

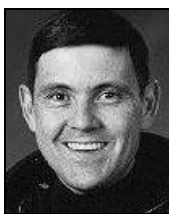
The first spacewalk will consist primarily of attaching umbilicals and connectors between the mating adapters, Unity and Zarya. Ross and Newman will begin by setting up the payload bay and worksites for the three spacewalks. A slidewire will be installed first for safety and to provide clearances while connecting umbilicals between the first mating adapter and Unity. Eight umbilicals will be connected, four primary and four redundant. Following the umbilical connections, Ross and Newman will remove thermal covers from the exterior computers, called multiplexer-demultiplexers (MDMs), on Unity.

Command checks between Mission Control, Houston, and Mission Control, Moscow, will be conducted the next day while the crew pressurizes the Orbiter Docking System vestibule, completes leak checks and prepares S-band communications equipment for installation on the second spacewalk. The ground control checks will include verifying the ability to command Zarya from Houston via the Moscow control center. The mating adapter attached to the Zarya will be pressurized via remote commands and checked for leaks. Filters and fans in Unity and Zarya will be powered on as well.

On the second spacewalk, Ross and Newman will install handrails and worksite interfaces as well as remove hatch and petal launch restraints from both the left and top berthing ports on Unity. The two astronauts also will install antennas for an S-band early communications system, a sunshade for the MDMs and trunnion pin covers. On the next day, the day before the final spacewalk, the crew will enter Unity and Zarya through the Shuttle docking mechanism for the first time. Once inside, portable fans and lights will be installed along with additional components of the S-band early communications system.

The third and final spacewalk will begin with the astronauts disconnecting a wiring harness on one of Unity's mating adapters and safely covering the connectors. Connector cables then will be installed on the Assembly Power Converter Unit. Tool boxes will be stowed on the outside of Unity for use by future assembly crews. The spacewalkers also will venture to the far end of Zarya to install a handrail and other equipment. The next day, Endeavour will undock from the new station, completing the first International Space Station assembly mission. For more information on the International Space Station, visit the home page at <http://station.nasa.gov>.

## STS-88 Crew



**Robert D. (Bob) Cabana**, 48, Col., USMC, will command STS-88. Selected as an astronaut in 1985, Cabana was born in Minneapolis, Mn., and will be making his fourth space flight. Cabana's first flew as pilot of STS-41 in October 1990, deploying the Ulysses probe to study the Sun's polar regions. He flew as pilot of STS-53 in December 1992, a classified mission, and he commanded STS-65 in July 1994, a lab flight with 80 experiments from 15 countries. He has logged over 353 hours in space and over 5,000 flying hours in 33 types of aircraft.



**Frederick (Rick) Sturckow**, 35, Capt., USMC, will be pilot. Selected as an astronaut in 1994, Sturckow considers Lakeside, Ca., his hometown and will be making his first space flight. Sturckow earned his wings in the Marine Corps in 1987 and attended the Navy Fighter Weapons (Topgun) School in 1990. He flew 41 combat missions during Operation Desert Storm. He later attended the Air Force Test Pilot School and was a test pilot at the Naval Air Warfare Center, Patuxent, Md. He has logged more than 2,500 flying hours in over 40 different aircraft.



**Nancy J. Currie**, Ph. D., 38, Major, USA, will be a mission specialist on STS-88. Selected as an astronaut in 1990, Currie considers Troy, Oh., her hometown and will be making her third space flight. Currie first flew on STS-57 in June 1993, a mission that retrieved the EURECA satellite. She next flew on STS-70 in July 1995, a mission that deployed a NASA communications satellite. Currie has logged over 454 hours in space.



**Jerry L. Ross**, 49, Col., USAF, will be a mission specialist and EVA crew member. Selected as an astronaut in 1980, Ross was born in Crown Point, In., and will be on his sixth space flight. Ross flew as a mission specialist on STS 61-B in December 1985; STS-27 in December 1988; STS-37 in April 1991; STS-55 in April 1993; and STS-74 in November 1995. He has logged over 850 hours in space, including 23 hours on four spacewalks.



**James H. (Jim) Newman**, Ph.D., 40, will serve as a mission specialist and extravehicular activity crew member. Selected as an astronaut in 1990, Newman considers San Diego, Ca., his hometown and will be making his third space flight. Newman served as a mission specialist on STS-51 in September 1993 and on STS-69 in September 1995. He has logged more than 496 hours in space, including 7 hours on one spacewalk.



**Sergei Krikalev**, 40, Russian cosmonaut, will be a mission specialist. Selected as a cosmonaut in 1985, Krikalev was born in Leningrad (now St. Petersburg), Russia, and will be on his fourth space flight. He flew twice on the Mir space station, in 1988 and in 1991. He flew once on the Space Shuttle, the first cosmonaut to do so, on STS-60 in 1994, the first Shuttle rendezvous with Mir. He also is a member of the first crew set for launch to the International Space Station in July 1999. He has logged more than 1 year and 3 months in space, including seven spacewalks.